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CERTIFICATE

This certificate is issued in support of an application for Patent registration in a country outside New Zealand pursuant to the Patents Act 1953 and the Regulations thereunder.

I hereby certify that annexed is a true copy of the Provisional Specification as filed on 6 August 2002 with an application for Letters Patent number 520567 made by SIMON ROBERT WARD.

Dated 28 August 2003.

PRIORITY DOCUMENT
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PROVISIONAL SPECIFICATION

CUTTING OR CRUSHING IMPLEMENT

I Simon Robert Ward, a New Zealand citizen of 3/17 Wootton Road, Remuera, Auckland, New Zealand,

do hereby declare this invention to be described in the following statement:

CUTTING OR CRUSHING IMPLEMENT

TECHNICAL FIELD

This invention relates to a cutting or crushing implement. Preferably the present invention may be adapted to provide a cutting or crushing implement which can be attached to and actuated by an excavator or other types of driving or earth working machinery. Those skilled in the art should appreciate however that other applications are however envisioned for this invention and reference to the above only throughout this specification should in no way be seen as limiting.

BACKGROUND ART

In some instances there is a need to cut a length of material into a number of small, shortened portions. For example, in demolition or construction work, there is sometimes the need to cut long lengths of resilient material such as reinforcing steel into a number of smaller lengths. In the case of demolition work a large tangled mass of reinforcing steel remains after a concrete structure has been demolished. To dispose of these lengths of steel it is preferable to cut it into a large number of small pieces, which can subsequently be handled and transported easier than the original mass.

Cutting long lengths of material into smaller lengths in effect increases the overall density of the collected cut material, in that there is less air in the volume occupied by the material. By increasing its density this allows the material to be handled, transported and disposed of both quickly an inexpensively.

One existing approach used to cut down such material is through the provision of a guillotine arrangement driven by some form of pneumatic or hydraulic ram. A length of the steel or other material to be cut is pulled or pushed through the guillotine jaw and the jaw is driven through the steel to complete the cut required.

However, there are a number of problems associated with the use of this type of apparatus. Specifically, only a single cut can be made for each pass of the blade which can in turn slow down the cutting process. Furthermore, it can be difficult to manoeuvre portions of a bent mass of steel through the guillotine jaws provided, which again can complicate and slow down cutting work.

A number of other different types of cutting, crushing or manipulating jaws have also previously been developed which attach to an excavator or other similar types of heavy machinery. These attachments can normally connect to the free end of an excavator's working boom and can be operated or actuated through hydraulic rams supplied with pressurised hydraulic fluid from the excavator.

However, these types of existing cutting or crushing implements also involve a number of problems when working with long lengths or tangled masses of material such as reinforcing steel.

The implements provided can only make a single cut through the length of material involved per operation or actuation of the implement. Furthermore, after each cut the implement must again be re-aligned with the next portion of the material to make an additional cut. As the earlier cuts will bend or twist the length further, additional time will be required to realign and manoeuvre the implement back into position to make a subsequent cut. These limitations make the cutting operation relatively slow and also can not necessarily guarantee that smaller lengths of material will be cut to a substantially uniform length or size. Operators of these excavators do not have fine control of the positioning of such implements, and as such, due to the realignment of the implement after each cut, different lengths of cut material will be produced.

It would be of advantage to have an improved shearing, cutting or pulverising apparatus or implement which addressed the above problems. It would be preferable to have an apparatus or implement which could cut long lengths or tangled collections

of material into a number of small lengths quickly and easily. It would also be preferable if the smaller lengths cut were of a substantially uniform length.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a cutting or crushing implement which includes,

a plurality of jaws which when operated are adapted to cut or crush a single length of

material at a plurality of separate points on said length of material,

whereby a single actuation of said implement causes each of said jaws to at least partially close.

According to a further aspect of the present invention there is provided a cutting or crushing implement substantially as described above where an actuation of the implement causes adjacent jaws to at least partially close consecutively.

According to a further aspect of the present invention there is provided a crushing or cutting implement substantially as described above wherein the consecutive closing of adjacent jaws places a first jaw in a cutting or crushing configuration and a second adjacent jaw in a clamping configuration.

According to yet another aspect of the present invention there is provided a cutting or crushing implement substantially as described above wherein each of the plurality of jaws includes at least one blade, wherein a leading edge of said at least one jaw's blade or blades is orientated opposite a leading edge of an adjacent jaw's blade or blades.

According to another aspect of the present invention there is provided a cutting or crushing implement substantially as described above wherein said jaws are adapted to pivot about a single common axis to at least partially close said jaws.

An implement formed in accordance with the present invention may be any type of apparatus or arrangement of elements which is adapted to connect to an actuator arm, boom or any piece of machinery that can operate the implement. Preferably such implements may be configured to cut, crush, crack or shear a number of different types of materials. For example in some embodiments the present invention may be used in the demolition industry to provide an implement which can perform at least one of the above functions on a demolition site.

Preferably the driving equipment which the implement is adapted to connect to may be an excavator or any other similar type of heavy machinery. These types of machine are well known in the demolition and construction trades and as such will not be described in detail throughout this specification. Those skilled in the art should appreciate that reference to an excavator may encompass any type of machine which can be adapted to move or operate an implement configured in accordance with the present invention.

Reference throughout this specification will also be made to the implement being connected or attached to the actuator arm of an excavator. Excavators normally also include a hydraulic ram where the hydraulic fluid that operates the ram is supplied from the excavator. This ensures that a hydraulic ram can be used to actuate an implement formed in conjunction with the present invention.

However, those skilled in the art should also appreciate that the present invention need not necessarily be powered by a hydraulic ram and hydraulic fluid associated with an excavator. For example, in other embodiments, self-powered or self-driven implementations of the present invention may be provided. In such instances one or more independent driving rams or other similar driving apparatus may be provided as part of the implement, and used to operate or drive the jaws. This allows relatively large independent driving rams to be employed to cut through large, thick lengths of material if required.

Preferably the present invention is adapted to provide an implement to be attached to and operated by an excavator. This implement may be used to cut, crush or shear material easily and quickly through an operator maneuvering the boom of the excavator and subsequently actuating the implement.

Reference throughout this specification will also be made to the implement provided being used preferably to cut through lengths of reinforcing steel bars. However, those skilled in the art should appreciate that further applications are envisioned for the

present invention and reference to the above only throughout this specification should in no way be seen as limiting. For example, in other embodiments the implement may provide a crushing operation and need not necessarily be used with the reinforcing steel only. Furthermore, reference to cutting of reinforcing steel bars only throughout this specification should in no way be seen as limiting. For example, in other embodiments copper, aluminium or other non-ferrous metals may also be cut or crushed if required.

Preferably the implement provided may be adapted to cut a long length or tangled mass of reinforcing steel bars to a large number of smaller lengths of steel. These small lengths can then be densely packed and easily collected, stored, transported or recycled.

Preferably the implement includes a plurality of jaws. A jaw may be formed by two opposed elements which are adapted to move together to cut or shear a length of steel. A plurality of jaws may be provided to execute a plurality of cuts through the length of steel bar involved in one single operation or actuation of the implement. Furthermore, those skilled in the art should appreciate that the opposed members or elements of such jaws need not necessarily be fully closed together in some instances to make the cut required. For example, in some implementations these jaw components may only need to at least partially close to complete the cut required.

Preferably each of the plurality of jaws provided may act on or cut at a plurality of separate points along the length of the steel bar involved. This in turn allows multiple cuts to be made to a length of steel with a single actuation of the implement provided. The operator of the implement and associated excavator preferably need only position the implement in place with the steel to be cut between the jaws of the implement, and then actuate the implement to make a number of controlled cuts through a steel bar.

In a preferred embodiment each of the implement's jaws may be adapted to pivot closed to complete a cutting operation. Reference throughout this specification will also be made to the jaws provided being adapted to pivot together or closed to complete a cut. However, those skilled in the art should appreciate that other jaw configurations may be provided such as, for example, a guillotine type action, and reference to pivoting jaws only throughout this specification should in no way be seen as limiting.

Preferably a single actuation only of the implement will cause all of the jaws provided to close. This allows a plurality of cuts to be made quickly and easily with the present invention. Furthermore, as each jaw works or operates on a separate point of the length being cut, a number of smaller cut lengths are produced when the implement is actuated, where these lengths have a known size being equal to the distance between adjacent blades. This allows a high degree of control to be provided with respect to the lengths cut using the present invention.

In one alternative embodiment the present invention may include a jaw displacement system which is adapted to modify, manouvre or change the distances between each adjacent jaw. By changing these width or distance values, the known size or length of the cuts being made can be modified or controlled. For example, in one embodiment, each jaw may be attached to the main body of the implement through a connection to positioning ram, whereby the position of the jaw with respect to the main body of the implement is controlled by the displacement of a piston associated with this ram. Actuation of the piston can then control the position of the jaw with respect to the main body of the implement and hence the position of the jaw with respect to adjacent jaws.

Reference throughout this specification will be made to the distance between each of the jaws of the implement being fixed, but those skilled in the art should appreciate that other implementations of the present invention are envisioned and reference to the above only throughout this specification should in no way be seen as limiting.

In a further preferred embodiment each of the blades provided may pivot about a single common axis. This will place the ends or corners of each adjacent jaw set in an overlapping position, preferably with shims provided between each adjacent jaw. As the blades provided act on a common axis, this eliminates the possibility that with wear an upper most portion of the jaw fall out of alignment with the lower portion subsequently block fall against the main body of the lower jaw.

Preferably the implement is configured to be actuated through the operation of a hydraulic ram associated with an excavator boom. This hydraulic ram can provide a driving actuation force where this force can in turn be transmitted directly to each of the plurality of blades provided within the implement. A single actuation of this ram will in turn trigger multiple cuts being made to a length of steel or other material.

Reference throughout this specification will also be made to the implement being actuated through a single operation of an excavator ram. However, as discussed above, in alternative embodiments the implements may include its own driving ram or other similar power system and need not necessarily rely on an excavator ram to be actuated.

In a preferred embodiment the implement may include three jaws only aligned along the central pivot axis. Three jaws may be provided to complete three distinct cuts through reinforcing steel bars or other types of material with a single actuation only of the implement.

Reference throughout this specification will also be made to the implement being provided with three jaws only. However, those skilled in the art should appreciate that any number of jaws may be provided if required in other embodiments, and reference to the above only throughout this specification should in no way be seen as limiting.

In a preferred embodiment the implement is configured so that when actuated each of the jaws provided will close consecutively in a controlled staged manner. In this

configuration of the invention a first or leading jaw will close, to be followed consecutively by each following adjacent jaw.

This configuration of the invention will place a first jaw of the implement in a cutting or crushing configuration and a second adjacent jaw in a clamping configuration. The first jaw to move or close will in fact cut the length of material first, with the adjacent jaw involved moving into a clamping position. While the first or initial jaw is cutting, the second adjacent jaw (which is not fully closed) will grip and hold steady the following portion of the length of steel being cut. For example, if reinforcing the steel is to be cut the second or adjacent jaw to the first or primary jaw will hold the steel bar in place and prevent it from bending, twisting or warping when the first cut is made.

Furthermore, this consecutive closing of each adjacent jaw of the implement allows a plurality of cuts to be made while the material being cut is held securely in place. With the exception of the last cutting jaw provided the material cut will be firmly clamped and prevented or bending or warping when cuts are completed.

In a preferred embodiment a single jaw may be formed from two opposed V shaped elements. The upper element or portion of the jaw may be formed from an inverted V shaped form, whereas the lower element may be formed from an upright V shaped form. The use of this specific shape of jaw elements aids in the clamping facility provided by the jaw adjacent to the current cutting jaw. Four distinct contact points are provided by the closing jaw in a clamping configuration to secure or clamp the material currently being cut.

In a preferred embodiment each of the implement's jaws may include at least one blade, which in turn incorporates or forms a leading edge. A blade portion may be provided on either or both of the upper or lower elements of a jaw and can easily shear and cut through material placed within the jaw as the jaw is closed. Each of the blades with a leading edge then define a working face for a jaw, which in turn determines in

what direction side loading forces are applied to the implement when material is cut by the jaw. As each jaw is squeezed closed through the material being cut, a lateral or side force is applied to the jaw. The direction of the side loading force will then be determined by which side of the jaw the leading edge or edges of its blade or blades are provided.

In a further preferred embodiment the blade or blades of the jaw and their associated leading edges can be orientated to oppose the blade or blades and associated leading edges of an adjacent jaw. This configuration of the invention provides side load balancing through each jaw. A side load applied by a first jaw will in turn be opposed by the adjacent jaw involved, thereby canceling out the net side load forces applied to the implement when in operation. These side load forces can be a balance for each adjacent pair of jaws provided. Every odd numbered jaw can in turn be opposed or faced by every even number jaw provided within the implement.

The present invention provides many potential advantages over the prior art.

An implement formed in conjunction with the present invention can use a plurality of jaws to make a number of cuts with a single actuation or operation of the implement. This can substantially speed up the cutting work required using such an implement.

Furthermore, due to the use of a plurality of jaws, a controlled cut distance will be applied to produce a number of lengths of cut material with a known length. In one alternative embodiment, a jaw displacement system may be provided to modify the distances between each jaw and hence control the length of cut applied by the jaws with a single actuation of the implement. In addition, the clamping facility provided by an adjacent jaw to the cutting jaw minimises warping or bending of the material involved as it is cut.

The provision of opposed working faces of adjacent jaws also minimises and cancels out side loading of forces applied to the implement when operated. This can

substantially increase the useful life span of the implement and potentially also reduce maintenance problems.

The consecutive motion applied to each adjacent jaw means that the power developed and transmitted by the implement's driving power source is employed continuously to make a number of cuts. A relatively low power or low capacity driving ram may be used for example, which is continuously loaded as each consecutive cut is made. As the cuts required are staged, a relatively low power ram may be used in comparison with a high capacity high power ram which would be required if all cuts were made at approximately the same time.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

Figures 1a & 1b — show a side cross-section and end view of a cutting or crushing implement formed in accordance with a preferred embodiment of the present invention, and

Figures 2a & 2b — show the implements of Figures 1a, 1b when attached to an excavator and in use.

BEST MODES FOR CARRYING OUT THE INVENTION

Figures 1a & 1b show a side cross-section and end view of a cutting or crushing implement formed in accordance with a preferred embodiment of the present invention, and

An implement 1 is shown in accordance with a preferred embodiment of the present invention. This implement is adapted to be connected to the end of a boom, working

arm and port strut of an excavator, as shown and discussed in more detail with respect to Figures 2a and 2b.

The implement 1 includes three sets or pairs of jaws 3. The lower portion of each jaw is provided through a V shape form, whereas the upper portion or element of each jaw is provided by an inverted V shaped form.

Each of the jaws 3 are connected and associated with a central pivot axis 4 of the implement. Each of the upper and lower portions of the jaws 3 are pivoted towards or away from each other about this main pivot of the implement. Each of the upper and lower sections of the jaws 3 are directly attached to an upper body portion 5 or lower body portion 6 of the implement respectively. When the upper body portion 5 is pivoted towards the lower portion 6 the three sets of jaws 3 are then pivoted towards one another and can be closed on one another to perform a cutting operation. A single actuation of the implement may perform three cut cutting operations through the movement of the head portion only 5 and subsequent pivoting of the top portions of each of the jaws 3a, 3b and 3c.

The jaws 3 are displaced across the width of the implement, so that a length of material inserted between the jaws will be cut at three distinct and separate points when it contacts each of the jaws 3.

As can be seen from Figure 1a, a cut will only be completed when each jaw is fully closed, but in other embodiments of the present invention this may not necessarily be the case.

Each of the upper and lower sections of the jaws 3 are arrayed at off-set heights with respect to one another to ensure that adjacent jaws close consecutively with respect to one another. In the instance shown the jaw 3a will close first, followed by jaw 3b and finally jaw 3c.

Initial actuation of the implement 1 will push jaws 3a closed placing it in a cutting configuration, while in turn pushing jaws 3b at least partially closed and therefore into a clamping configuration. In this instance jaw 3b will hold and clamp a length of material while the material is being cut by jaw 3a. The same operation is then completed sequentially or consecutively in turn as jaw 3b cuts through the same material in a cutting configuration, while jaw 3c works in a clamped configuration. Finally, jaw 3c will move through to make a final cut through the length of material involved.

This means that after any jaw has finished clamping it will subsequently move through to cut the material involved. The operation of the jaws are staged, and each jaw will subsequently clamp and then cut through the material being worked by the implement.

Figure 1b also shows how the working faces of adjacent jaws may be orientated with respect to one another. Each of the bottom sections of the jaws 3 include a blade portion 7a through 7c which presents a leading edge of the blade and subsequently defines a working face for the jaw involved.

Adjacent jaws 3a and 3b have their working faces orientated opposite one another to balance side loading forces applied to the implement when in use. The working face of jaw 3 is not aligned due to an odd number of jaws being provided with the implement shown.

The working face of jaw 3a will apply a lateral or side loading force in towards the centre of the implement, whereas the working face of jaw 3b applies the same force but in the opposite direction. This balancing of forces cancels out side loads applied to the implement by jaws 3a and 3b.

Figures 2a and 2b show the implement of Figures 1a, 1b when used. In the instance shown the implement 4 is attached to the boom 8, driving arm 9 and strut 10 of an excavator.

Figure 2a shows the jaws provided when fully open prior to a cutting operation, whereas Figure 2b shows the jaws positioned after three cuts have been made. As can be seen from Figure 2a in combination with Figure 2b, a driving ram acting to push the driving arm 9 of the excavator will in turn pivot top portions of the jaws 3 about the main axis 4, to close the jaws and complete a cutting operation. The single actuation of the implement will then result in three separate cuts to be made to a length of material placed between the jaws 3.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

SIMON ROBERT WARD

by his Attorneys

JAMES & WELLS

Fig 1a

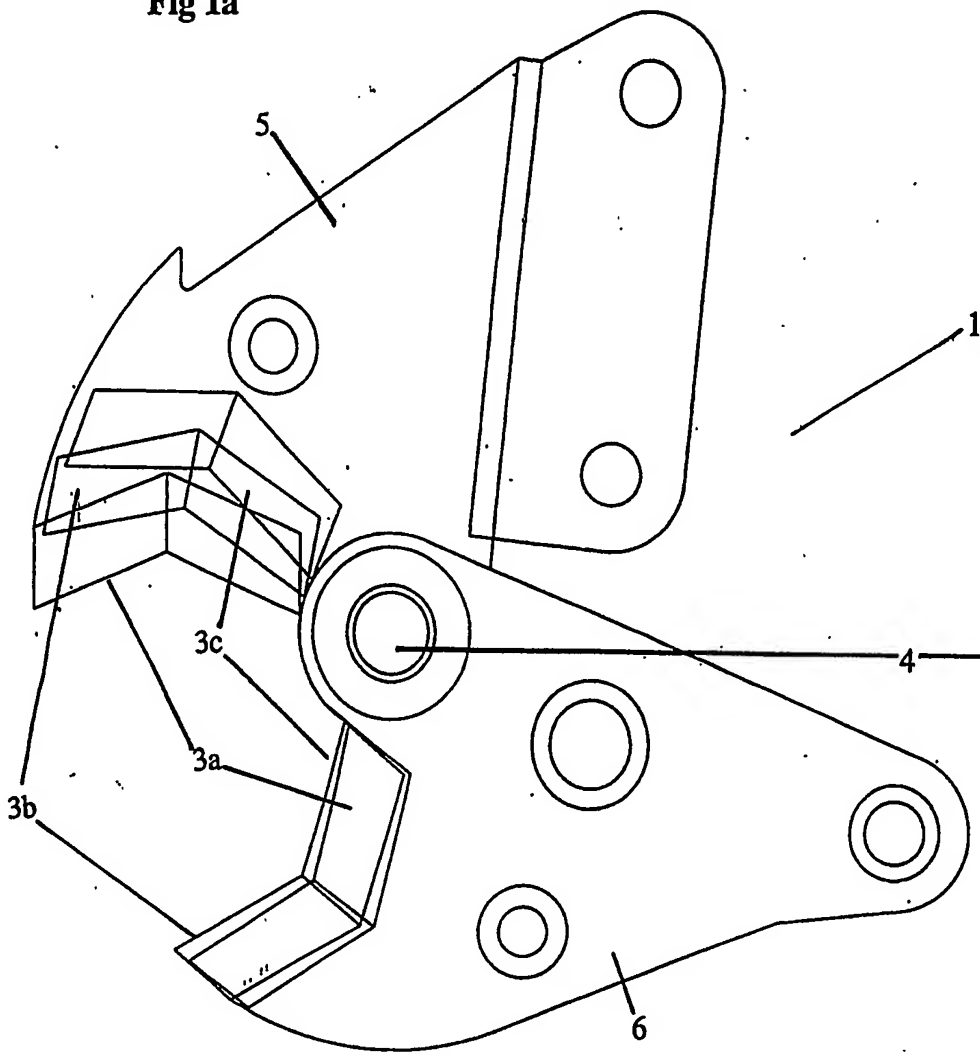
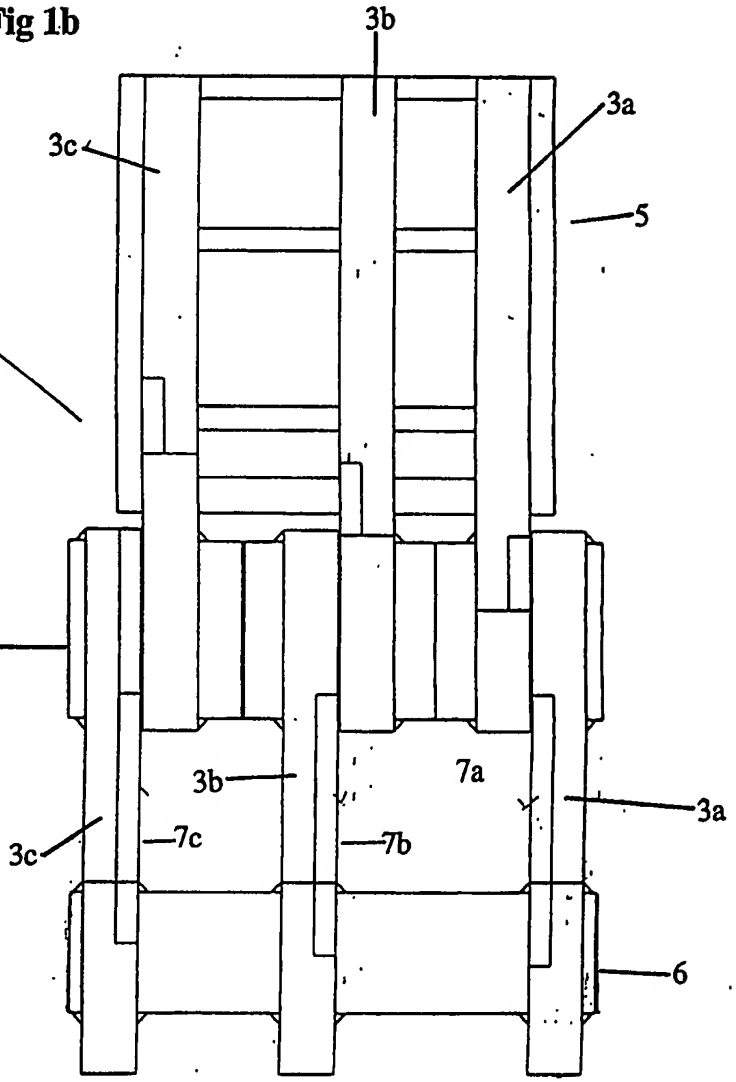


Fig 1b



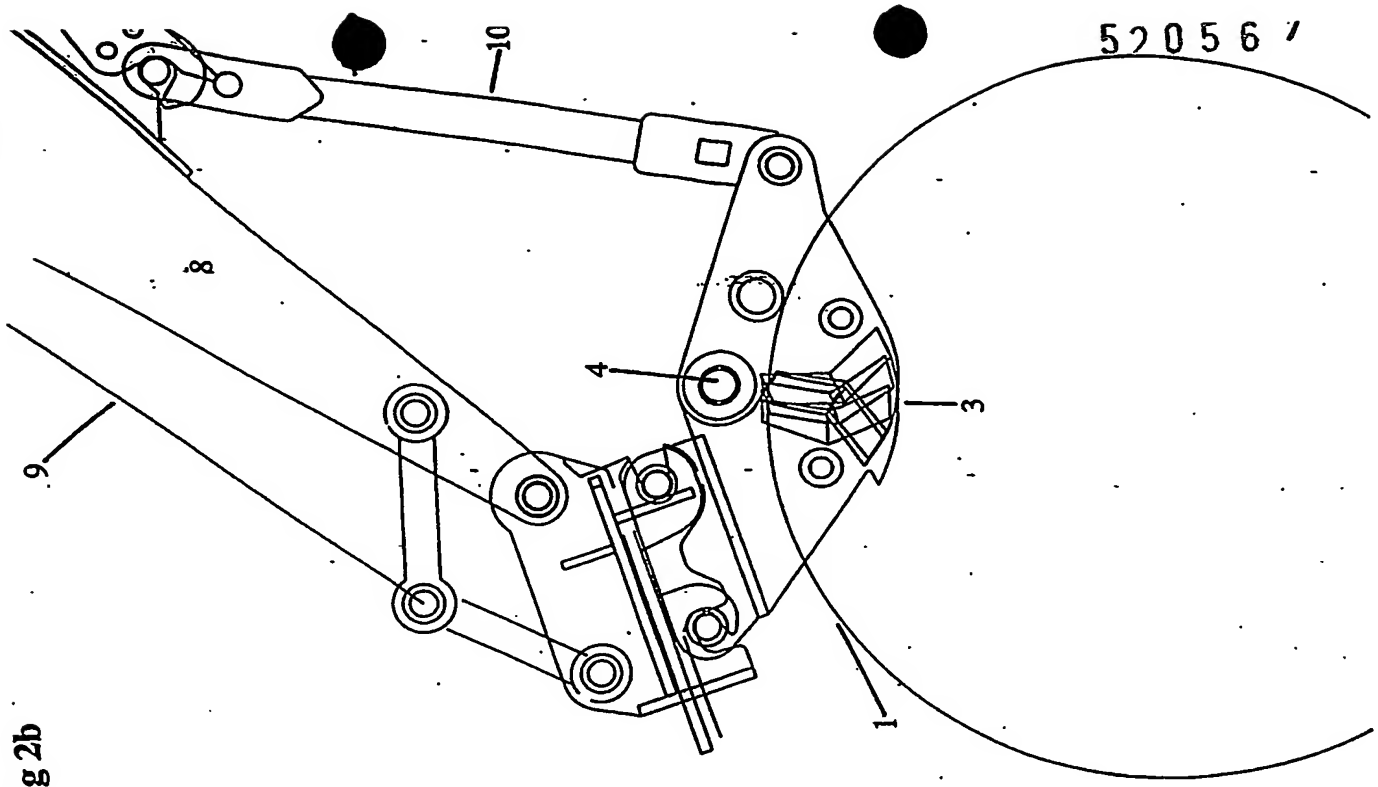


Fig 2b

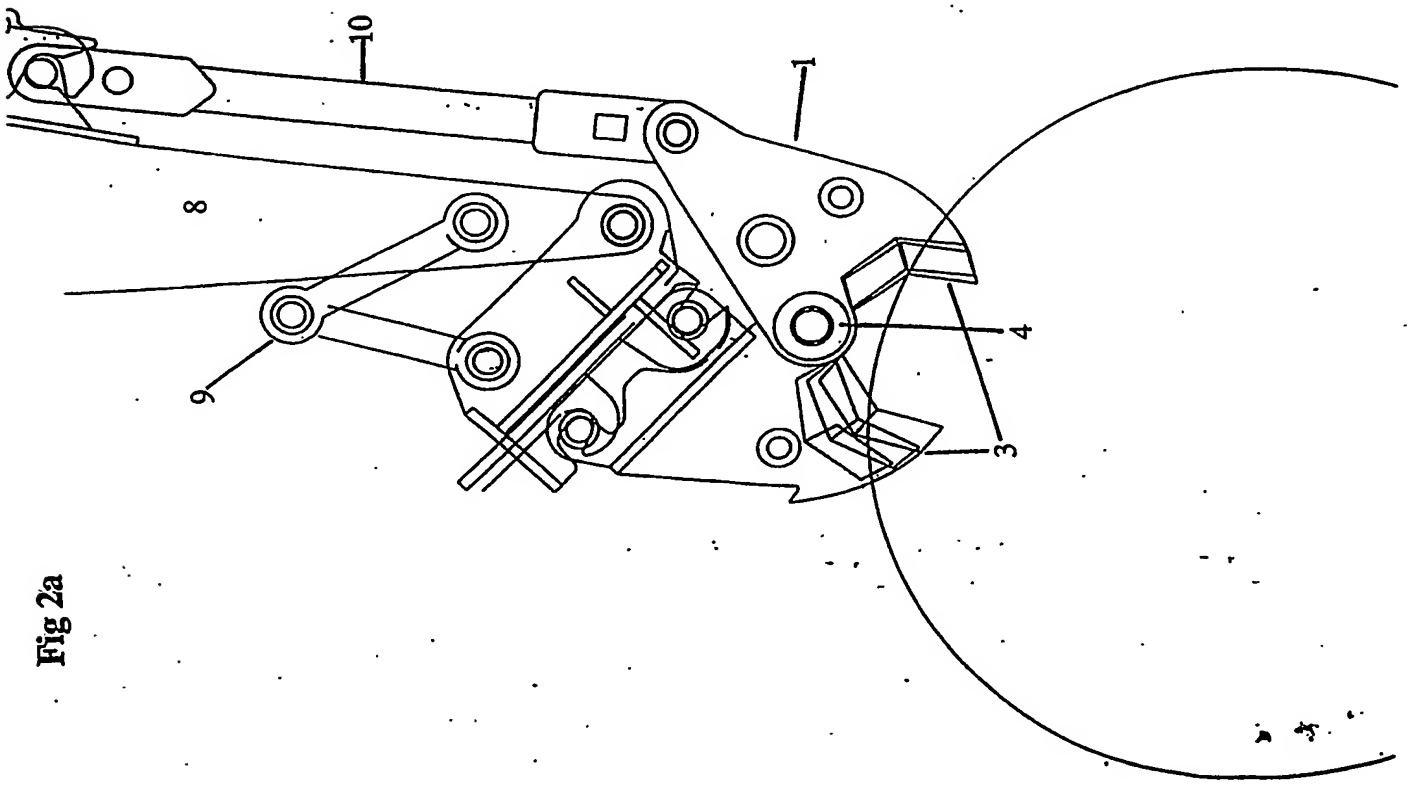


Fig 2a